

WHAT IS CLAIMED IS:

1. A method of controlling a gas concentration sensor that generates a sensor current signal related to a detected gas concentration, comprising the steps of:

selectively changing a voltage provided to the sensor during a sensor resistance detection cycle;

detecting a change in a sensor current signal resulting from the step of selectively changing a voltage;

detecting resistance of the sensor based on the step of detecting a change in a sensor current signal; and

interrupting the change in the sensor gas concentration signal, according to predetermined sensor parameters, to inhibit generation of erroneous gas concentration signals during the step of selectively changing a voltage.

2. The method of Claim 1, wherein the step of interrupting the change in the sensor gas concentration signal comprises the step of holding the sensor gas concentration signal, detected prior to the step of selectively changing a voltage, for a predetermined time period both before, and after, the step of selectively changing a voltage, to inhibit generation of erroneous gas concentration signals during the step of selectively changing a voltage.

3. A method of controlling a gas concentration sensor that generates a sensor current signal related to a detected gas concentration, comprising the steps of:

selectively changing a voltage provided to the sensor during a sensor resistance detection cycle;

detecting a change in a sensor current signal resulting from the step of selectively changing a voltage;

detecting resistance of the sensor based on the step of detecting a change in a sensor current signal; and

inhibiting use of the sensor gas concentration signal, according to predetermined sensor parameters, to inhibit generation of erroneous gas concentration signals during the step of selectively changing a voltage.

4. A method of controlling a gas concentration sensor that generates a sensor current signal related to a detected gas concentration, comprising the steps of:

selectively changing a voltage provided to the sensor during a sensor resistance detection cycle;

detecting a change in a sensor current signal resulting from the step of selectively changing a voltage;

detecting a resistance of the sensor based on the step of detecting a change in a sensor current signal;

inhibiting use of the sensor gas concentration signal, according to predetermined sensor parameters, to inhibit generation of erroneous gas concentration signals during the step of selectively changing a voltage, and for a predetermined period thereafter; and

holding a gas concentration signal detected prior to the step of selectively changing a voltage until a predetermined time period elapses after the step of detecting a resistance of the sensor.

5. A method of controlling a gas concentration sensor that generates a sensor current signal related to a detected gas concentration, comprising the steps of:

detecting a gas concentration corresponding to a sensor critical current;

selectively changing a voltage provided to a sensor during a sensor resistance detection cycle;

detecting a change in a sensor current signal resulting from the step of selectively changing a voltage;

detecting resistance of the sensor based on the step of detecting a change in a sensor current signal; and

increasing a temperature of the sensor to a temperature corresponding to a sensor active state; and

pausing between the steps of detecting a gas concentration and selectively changing a voltage, and between the steps of selectively changing a voltage and increasing a temperature, to minimize a processing load caused by said steps.

6. A method of controlling a gas concentration sensor that generates a sensor current signal related to a detected gas concentration, comprising the steps of:

selectively changing a voltage provided to a sensor during a sensor resistance detection cycle;

detecting a change in a sensor current signal resulting from the step of selectively changing a voltage;

detecting a sensor resistance based on the step of detecting a change in a sensor current signal; and

changing the sensor resistance according to predetermined sensor operating parameters in response to the step of detecting a sensor resistance; and

limiting sensor resistance change in the step of changing the sensor resistance according to the predetermined operating parameters.

7. The method of Claim 6, wherein the step of limiting sensor resistance change enables a large change when a sensor temperature is increasing, and enables only a small change when the sensor temperature has reached a predetermined temperature.

8. A method of controlling a gas concentration sensor that generates a sensor current signal related to a detected gas concentration, comprising the steps of:

selectively changing a voltage provided to a sensor during a sensor resistance detection cycle;

detecting a change in a sensor current signal resulting from the step of selectively changing a voltage;

detecting a sensor resistance value based on the step of detecting a change in a sensor current signal; and

filtering the sensor resistance value to create a filtered sensor resistance;

changing filtering parameters in the step of filtering to limit an amount of change of the sensor resistance to maintain the sensor resistance within a predetermined range.

9. A method of controlling a gas concentration sensor that generates a sensor current signal related to a detected gas concentration, comprising the steps of:

selectively changing a voltage provided to a sensor during a sensor resistance detection cycle;

detecting a change in a sensor current signal resulting from the step of selectively changing a voltage;

detecting a sensor resistance value based on the step of detecting a change in a sensor current signal;

determining if an absolute difference between a sensor resistance value, detected during the step of detecting a sensor resistance value, and a previous sensor resistance value is less than or equal to a given incremental resistance value;

adding the incremental resistance value to the present resistance value if the absolute value of the difference is less than or equal to the incremental resistance value; and

retaining the sensor resistance value if the absolute value of the difference is greater than the incremental resistance value.

10. A method of controlling a gas concentration sensor that generates a sensor current signal related to a detected gas concentration, comprising the steps of:

a) selectively changing a voltage provided to a sensor during a sensor resistance detection cycle;

b) detecting a change in a sensor current signal resulting from the step of selectively changing a voltage;

c) detecting a sensor resistance value based on the step of detecting a change in a sensor current signal;

d) repeating steps a)-c) a plurality of times;

e) averaging a plurality of sensor resistance values detected during the plurality of times that step c) is repeated; and

f) adjusting the sensor resistance based on an average sensor resistance value determined in step e).

11. The method of Claim 10, wherein the step of adjusting the sensor resistance further comprises the steps of:

erasing the (n-1)th sensor resistance value; and

storing a current sensor resistance value prior to step e) above.



12. A method of controlling a gas concentration sensor that generates a sensor current signal related to a detected gas concentration, comprising the steps of:

selectively changing a voltage provided to a sensor during a sensor resistance detection cycle according to a map of sensor resistance values as parameters;

monitoring a subsequent temperature associated with the sensor; and

limiting a map selection range when the step of selectively changing a voltage is repeated, if an increase in temperature is detected during the step of monitoring a subsequent temperature associated with the sensor, to maintain the sensor resistance within a predetermined range.

13. A method of controlling a gas concentration sensor that generates a sensor current signal related to a detected gas concentration, comprising the steps of:

selectively changing a voltage provided to a sensor during a sensor resistance detection cycle based on a map of sensor resistance values to determine sensor resistance;

determining if a present sensor resistance is greater than or equal to a previous sensor resistance;

selecting an applied voltage map to adjust the present sensor resistance based on the step of determining to ensure that a voltage is applied to the sensor within a normal range of control.

14. A method of controlling a gas concentration sensor that generates a sensor current signal related to a detected gas concentration, comprising the steps of:

selectively changing a voltage provided to a sensor during a sensor resistance detection cycle based on a map of sensor resistance values to determine sensor resistance;

determining if a present sensor resistance is greater than or equal to a previous sensor resistance;

selecting a first applied voltage map to adjust the present sensor resistance based on the step of determining if a present sensor resistance is greater than or equal to a previous sensor resistance;

determining if conditions during the step of selecting an applied voltage map are fixed;

selecting a second applied voltage map that is available after the step of determining if conditions during the step of selecting an applied voltage map are fixed; and

calculating an applied voltage based on the step of selecting a second applied voltage map to ensure that a voltage is applied to the sensor within a normal range of control.

15. A gas concentration sensor, comprising:

a sensor element located in proximity to a gas supply that generates a current proportional to a detected gas concentration;

a heater located in proximity to the sensor element that heats the sensor element; and

a controller that selectively controls operation of the sensor element and the heater;

the controller activating the sensor element to generate the current signal during a gas detection cycle in response to predetermined conditions, the controller also activating the heater to heat the sensor element to a predetermined active state temperature to ensure proper operation of the sensor element;

the controller selectively changing a voltage provided to the sensor element during a sensor element resistance detection cycle, and sensing a resulting current change in the sensor element, to detect a corresponding sensor element resistance; and

the controller controlling the gas detection cycle and the sensor element resistance detection cycle to maintain detected gas concentrations within a normal range during the sensor element resistance detection cycle.

16. The method of Claim 15, wherein the sensor element is operative to detect a concentration of oxygen during an exhaust cycle of a multi-cylinder motor vehicle internal combustion engine.